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EXAMINER	
NGUYEN, TU MINH	
ART UNIT	PAPER NUMBER
3748	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/812,467	NAIK ET AL.	
	Examiner	Art Unit	
	Tu M. Nguyen	3748	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 August 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,10,11,13-18 and 27-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *18 and 39* is/are allowed.

6)☒ Claim(s) *1,10,11,13-17 and 27-36* is/are rejected.

7)☒ Claim(s) *37 and 38* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. An Applicant's Amendment filed on August 21, 2007 has been entered. Claim 12 has been canceled; claim 1 has been amended; and claims 37-39 have been added. Overall, claims 1, 10, 11, 13-18, and 27-39 are pending in this application.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office Action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 10, and 27-31 are rejected under 35 U.S.C. 102(e) as being anticipated by Litorell et al. (U.S. Patent 6,609,364).

Re claim 1, as shown in Figures 1-2, Litorell et al. disclose a method for controlling a direct injection internal combustion engine (1) selectively operative in one of a homogeneous charge combustion mode and a stratified charge combustion mode and having an exhaust gas conduit (17) fluidly connected to a NOx trap (18) generally effective to accumulate NOx emissions during lean operation of the engine and to release the accumulated NOx emissions during rich operation of the engine, comprising:

- defining a first engine operating region (stratified operating mode) as the only region in which stratified charge combustion mode is enabled;

- defining a second operating region (a transition mode to switch from stratified operating mode to homogeneous operating mode) consisting of a reduced portion of the first operating region, the second operating region operative to redefine the only area in which stratified charge combustion mode is enabled;

- monitoring engine operation (engine speed and engine load are monitored in order to determine an operating mode of the engine);

- determining a cumulative mass of NOx stored on the NOx trap device (see lines 54-59 of column 7);

- operating the engine in the stratified charge combustion mode only when the engine operation is within the first operating region (see lines 58-61 of column 8) and the cumulative mass of NOx stored on the NOx trap device is less than a first threshold (when the NOx trap is not filled); and

- operating the engine in the stratified charge combustion mode (in step 27) when the engine operation is within the second operating region and the cumulative mass of NOx stored on the NOx trap device is greater than the first threshold (when the NOx trap is filled, the engine is operated with a reduced stratified operating mode during a switch from stratified to homogeneous mode; wherein during this reduced stratified operating mode, an engine air-fuel ratio is first reduced (in step 28) to a lean combustion limit ($\lambda 1$), and wherein the lean combustion limit is selected as a highest value where a stable combustion is still present).

Re claim 27, in the method of Litorell et al., the first and second engine operating regions comprise engine operating regions defined in terms of an engine speed range and an engine load range.

Re claims 28-29, in the method of Litorell et al., defining the second operating region consisting of the reduced portion of the first operating region comprises reducing the engine speed range and the engine load range of the first operating region (before switching to homogeneous mode (in step 29), an air flow is reduced (in step 27), which causes a reduction in engine speed and engine load).

Re claim 30, the method of Litorell et al. further comprises operating the direct-injection internal combustion engine selectively operative in the homogeneous charge combustion mode when the engine operation is outside the first operating region when the cumulative mass of NOx stored on the NOx trap device is greater than the threshold (see lines 27-30 of column 7).

Re claim 31, the method of Litorell et al. further comprises regenerating the NOx trap by controlling the engine-out air-fuel ratio to an air-fuel ratio rich of stoichiometry.

Re claims 10, as depicted in Figures 1-2, Litorell et al. disclose a method for controlling regeneration of a lean NOx trap (18) comprising:

- estimating an accumulated NOx in a NOx trap located in the exhaust path of an engine (1) (see lines 54-59 of column 7); and,

- hastening regeneration of the NOx trap by reducing the size of a stratified charge operating region of the engine (the engine air-fuel ratio is first reduced (in step 28) to a lean combustion limit ($\lambda 1$) with reduced air flow (in step 27), wherein the lean combustion limit is selected as a highest value where a stable combustion is still present) when the accumulated

NOx exceeds a first threshold value (when the NOx trap is filled (see lines 54-59 of column 7)) and initiating regeneration (in step 31) when a full stratified charge operating region of the engine is exited (when step 28 has YES answer, step 29, and step 30 has YES answer);

wherein reducing the stratified charge operating region comprises reducing engine speed and engine load at which to operate the engine in stratified charge operating mode (before switching to homogeneous charge operating condition (in step 29), an air flow is reduced (in step 27), which causes a reduction in engine speed and engine load).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 32 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Litorell et al. as applied to claims 31 and 1, respectively, above, in view of Ishii et al. (U.S. Patent Application 2002/0029562).

Re claim 32, the method of Litorell et al. discloses the invention as cited above, however, fails to disclose that the method further comprises monitoring exhaust gas output from the NOx trap, and, ending the regenerating of the NOx trap when the monitored exhaust gas indicates a rich deviation of gases flowing out of the NOx trap.

As shown in Figure 1, Ishii et al. disclose an engine exhaust purifying apparatus comprising a NOx trap (15) and a downstream air-fuel ratio sensor (25). As illustrated in Figure 6 and indicated in paragraph 0062, Ishii et al. teach that it is conventional in the art to terminate a regeneration event of the NOx trap when rich deviation of gases flowing out of the NOx trap is detected. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the sensor and teaching by Ishii et al. in the method of Litorell et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to timely regenerate a NOx trap.

Re claim 36, the method of Litorell et al. discloses the invention as cited above, however, fails to disclose that the method further comprises operating the engine in the homogeneous charge combustion mode and controlling the engine-out air-fuel ratio to regenerate the NOx trap when the determined cumulative mass of NOx stored on the NOx trap device exceeds a second threshold, the second threshold greater than the first threshold.

As shown in Figure 1, Ishii et al. disclose an engine exhaust purifying apparatus comprising a NOx trap (15). As depicted in Figure 11 and indicated in paragraph 0075, Ishii et al. teach that it is conventional in the art to force a regeneration step of the NOx trap when an accumulated NOx emissions exceeds a second predetermined threshold (TNOAMX) greater than a first predetermined threshold (TNOAP). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Ishii et al. in the method of Litorell et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to prevent inadvertent release of NOx emissions into the atmosphere.

6. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Litorell et al. as applied to claim 31 above, in view of Takeshima et al. (U.S. Patent 5,437,153).

The method of Litorell et al. discloses the invention as cited above, however, fails to disclose that the method further comprises a step of ending the regenerating of the NOx trap upon expiration of a regeneration timer.

As shown in Figure 1, Takeshima et al. disclose an engine exhaust purification device for an internal combustion engine, comprising a NOx trap (17). As illustrated in Figure 15, Takeshima et al. teach that it is conventional in the art to terminate a regeneration of the NOx trap upon expiration of a regeneration timer (when step 220 has YES answer). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Takeshima et al. in the method of Litorell et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to effectively regenerate a NOx trap.

7. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Litorell et al. as applied to claim 31 above, in view of applicant's admitted prior art.

The method of Litorell et al. discloses the invention as cited above, however, fails to disclose that the method further comprises a step of ending the regenerating of the NOx trap when the engine operation falls below a threshold value for the engine operating region.

Since applicant fails to challenge the examiner's official notice that it is well known to those with ordinary skill in the art to end a regeneration step of the NOx trap when an engine operation falls below a threshold value for the engine operating region, it is therefore assumed that applicant has acquiesced with the examiner on such features or limitations.

8. Claims 35 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Litorell et al. as applied to claims 1 and 10, respectively, above, in view of Wachii et al. (U.S. Patent 6,763,657).

Re claim 35, the method of Litorell et al. discloses the invention as cited above, however, fails to disclose that the method further comprises the steps of monitoring temperature of the NOx trap; and controlling the engine-out air-fuel ratio to regenerate the NOx trap when the temperature exceeds a predetermined temperature threshold.

As shown in Figure 1, Wachi et al. disclose an engine having a NOx trap (6) and a temperature sensor (9) to monitor a temperature of the NOx trap. As depicted in Figure 2, Wachi et al. teach that it is conventional in the art to determine (in step S02) a temperature of the NOx trap, and control (in step S09) an engine-out air-fuel ratio to regenerate the NOx trap when the temperature exceeds a predetermined temperature threshold (step S08 with YES answer). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Wachi et al. in the method of Litorell et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to increase a regeneration efficiency of the NOx trap.

Re claim 11, the method of Litorell et al. discloses the invention as cited above, however, fails to disclose that the method further comprises the steps of estimating the temperature of the NOx trap; and determining a desired air-fuel ratio for initiating regeneration of the NOx trap, the desired air-fuel ratio being determined based upon one or a combination of the estimated accumulated NOx stored within the NOx trap and the temperature of the NOx trap.

As shown in Figure 1, Wachi et al. disclose an engine having a NOx trap (6) and a temperature sensor (9) to estimate a temperature of the NOx trap. As depicted in Figures 2 and 3, Wachi et al. teach that it is conventional in the art to determine (in step S09) a desired air-fuel ratio for initiating regeneration of the NOx trap, wherein the desired air-fuel ratio being determined based upon one or a combination of the estimated accumulated NOx stored within the NOx trap and the temperature of the NOx trap (see Figure 3). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the teaching by Wachi et al. in the method of Litorell et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to increase a regeneration efficiency of the NOx trap.

9. Claims 13 and 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Litorell et al. as applied to claim 10 above, in view of Takeshima et al.

Re claim 13, the method of Litorell et al. discloses the invention as cited above, however, fails to disclose that the method further comprises a step of terminating regeneration and resetting the accumulated NOx to the level of the remaining stored NOx in the lean NOx trap when a regeneration ending event is reached.

As shown in Figure 1, Takeshima et al. disclose an engine exhaust purification device for an internal combustion engine, comprising a NOx trap (17). As illustrated in Figure 15, Takeshima et al. teach that it is conventional in the art to terminate a regeneration of the NOx trap and reset (in step 221) an accumulated NOx to a level of the remaining stored NOx in the lean NOx trap when a regeneration ending event is reached (step 220 with YES answer). It would have been obvious to one having ordinary skill in the art at the time of the invention was

made, to have utilized the teaching by Takeshima et al. in the method of Litorell et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to effectively regenerate a NOx trap.

Re claim 15, in the modified method of Litorell et al., as taught by Takeshima et al., the method further comprises a step of monitoring the elapsed regeneration event time (in step 220), wherein the regeneration ending event is reached when the elapsed regeneration event time exceeds a target maximum regeneration event time interval.

Re claims 16-17, the method of Litorell et al. discloses the invention as cited above, however, fails to disclose that the method further comprises a step of monitoring driver torque demand on the engine, wherein the regeneration ending event is reached when the driver torque demand drops below a threshold value, and wherein the regeneration ending event is triggered by a driver initiated action.

Since applicant fails to challenge the examiner's official notice that it is well known to those with ordinary skill in the art to end a regeneration step of the NOx trap when an engine operation parameter such as a driver torque demand that is triggered by a driver initiated action, falls below a threshold value, it is therefore assumed that applicant has acquiesced with the examiner on such features or limitations.

10. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Litorell et al. in view of Takeshima et al. as applied to claim 13 above, and further in view of Ishii et al.

The modified method of Litorell et al. discloses the invention as cited above, however, fails to disclose that a regeneration ending event is reached when rich deviation of gases flowing out of the NOx trap is detected.

As shown in Figure 1, Ishii et al. disclose an engine exhaust purifying apparatus comprising a NOx trap (15) and a downstream air-fuel ratio sensor (25). As illustrated in Figure 6 and indicated in paragraph 0062, Ishii et al. teach that it is conventional in the art to terminate a regeneration event of the NOx trap when rich deviation of gases flowing out of the NOx trap is detected. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the sensor and teaching by Ishii et al. in the modified method of Litorell et al., since the use thereof would have been routinely practiced by those with ordinary skill in the art to timely regenerate a NOx trap.

Allowable Subject Matter

11. Claims 18 and 39 are allowed.

Claims 37-38 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

12. Applicant's arguments with respect to the references applied in the previous Office Action have been fully considered but they are not persuasive.

Re claim 1, in response to applicant's argument that Litorell et al. fail to disclose a second operating region consisting of a reduced portion of the first operating region, the second operating region operative to redefine the only area in which stratified charge combustion mode is enabled (pages 13-14 of the Applicant's Amendment), the examiner respectfully disagrees.

During a switch of the engine operating mode from a stratified combustion mode to a homogeneous combustion mode for a purpose of regenerating a NOx trap device, Litorell et al. do not let the engine to enter into a region C where a mixed combustion mode of stratified and homogeneous mode, as alleged by applicant (see page 14 of the Amendment). In fact, Litorell et al. perform a transition mode (steps 27 and 28) which is purely a stratified combustion mode before making the switch to a homogeneous combustion mode in step 29. In step 27, Litorell et al. adjust an intake throttle to reduce an air flow in order to bring an engine air-fuel ratio down to a lower threshold value ($\lambda 1$). Only when a lambda value of the engine is less than $\lambda 1$ (step 28 with YES answer), a switch of engine operating condition from a stratified combustion mode to a homogeneous combustion mode. Thus, Litorell et al. clearly disclose the claimed limitation in dispute.

Re claim 10, in response to applicant's argument that Litorell et al. fail to disclose a step of reducing the stratified charge operating region by reducing engine speed and engine load at which to operate the engine in stratified charge operating mode (pages 18-20 of the Applicant's Amendment), the examiner again respectfully disagrees.

As explained before, Litorell et al. perform a transition mode (in steps 27-28) which is still a stratified combustion mode before making an actual switch to a homogeneous combustion mode in step 29. During the transition mode, Litorell et al. adjust an intake throttle valve (in step 27) to reduce an air flow amount into their engine. The reduction of air in step 27 is not small as alleged by applicant so that the engine load in Litorell et al. can remain relatively constant during the transition. In fact, Litorell et al. need to bring an engine air-fuel ratio as high as 3 to a level as low as 1.2 during the transition mode before making the actual switch to a homogeneous

mode. To accommodate such a large decrease in air flow, an engine speed must be reduced in Litorell et al. And if a vehicle powered by the engine in Litorell et al. is on a flat road which is a fair assumption here, a reduction in engine speed induces a decrease in engine load. Therefore, Litorell et al. again clearly disclose the claimed limitation in dispute.

Conclusion

13. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Communication

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (571) 272-4862.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (571) 272-4859. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Tu M. Nguyen

TMN

October 29, 2007

Tu M. Nguyen

Primary Examiner

Art Unit 3748